ISS: Moving into the future

By Tommy Holloway, International Space Station Manager

It is now 2002 and we have a human outpost in space with permanent international presence, where micro gravity research is well under way.

The International Space Station is a bright new star darting overhead every 90 minutes, making its rounds over 95 percent of the Earth's population, and it is a beacon of something new. Human space flight has been transformed through ISS, and evolved into cooperative endeavors of world nations, businesses and academic institutions. There is great hope ahead, and many countries are betting on the returns from operating and using this incredible new station in Earth orbit.

The year 2001 has been both tough and tremendous: Tough because of the criticism NASA has received about cost management of the Program; tremendous because of the 20 space flights that were executed safely and extraordinarily well in the last 18 months.

The international technical teams have performed spectacularly, and continue working side-by-side to triumph over obstacles encountered large and small, while doing things never done before.

As we move into the future we will be challenged to keep the financial aspects of the Program on par with our technical performance. The budget situation on the NASA side of the house presents us with an interesting and difficult challenge. We need a path through this wilderness and we are forced to consider a broader set of issues beyond the Program management's reach, such as NASA-wide reorganization, research prioritization and guidelines for commercialization, to name a few.

The future of ISS will also depend on the things we can do:

- Safety first always – safety for the crew, safety for ground teams and safety for the hardware
- Maintain technical excellence
- Adhere to schedules
- Proactive and positive response for improving cost management and improving management information systems
- Keep our core values front and center: Safety, commitment, integrity, trust, respect for people and technical excellence

We've been directed to implement a set of recommendations per the ISS Management and Cost Evaluation (IMCE) Task Force Report issued November 2001. There is much work to be done to resolve the differences between the "U.S. core complete" baseline (defined by the Office of Management and Budget and NASA, and confirmed by IMCE) as the program baseline – with three-person crew, minus the Habitation Module and Crew Rescue Vehicle – and the Program baseline approved by the ISS partnership.

These challenges will need to be overcome as we continue our "climb up the mountain," building and operating the ISS.

The amazing year (and a half) of space flight

The July 12, 2000, Service Module launch set in motion an unprecedented succession of space flights – nine U.S. and 11 Russian.

In the year and a half before the Service Module launch, four missions went to ISS. A total of 24 flights (12 U.S./12 Russian) gave us the 300,000 pounds of micro gravity facility we have today, with nearly 15,000 cubic feet of living and working space, and our fourth Expedition in progress.

We've added 19kw of power with the P6 solar array on STS-97, quintupled on board computing and activated a fully functioning laboratory delivered on STS-98 in February 2001. All major systems are functioning nominally.

On ISS flight 6A, STS-100 in April 2001, we added state-of-the-art robotics system by deploying Canadarm2. We also installed an American joint airlock Quest in August 2001 and a Russian docking compartment called Pirs in September 2001, enhancing an aggressive schedule of spacewalking activity.

We have deployed 12 major elements on orbit: Zarya, Zvezda, Unity, 3 PMAs, Z-1, P6, Destiny, CanadaArm2, Quest and Pirs. The Station has a Soyuz lifeboat, reusable moving vans (MPLMs) and refuel/resupply (Progress) services.

We've logged 50,000 hours of U.S. payload run-time since STS-106 (September 2000). We have been experimenting in both U.S. and Russian segments and Expeditions have been averaging about 19 hours a week since April 2001. Our fourth Expedition crew arrived in December 2001 and is just beginning their increment, which will include work on 25 scientific payloads. Its been characterized as "the most diverse, most complex research program of any Expedition so far."

Amazing also describes the work done by ISS technical teams on the ground and on orbit to overcome challenges of all sizes – from delivering a series of extremely complex elements, to managing and executing the most intricate space operations in history, to recovering from multiple main computer failures. From learning how to deploy and fix the largest solar array, to re-programming robotic joints, to managing traffic jams.

Enormous effort has been expended to keep every aspect of ISS flight and operations "in a box" and moving at a safe pace. Review teams agree that the technical integration and engineering achievements building and operating the ISS have been "extraordinary." And that's because extraordinary people, in every sector of this Program, have done their job superbly.

The challenges of Phase 3: What's ahead for ISS

Phase 3 assembly and operations of ISS focuses on expanding and powering up the station toward its permanent configuration. We have an executable plan for 2002 and 2003, where we will expand the ISS structure, add more power and enable international support capability.

All of the U.S. hardware for the next two years is completing processing and will soon be ready to go. Japan and Europe continue to work on their laboratories, "Kibo" and "Columbus," to prepare for arrival on orbit in 2004 or early 2005.

Enhanced utilization and research is also a major goal for Phase 3. During this increment, we'll take up two more research racks, bringing the total to seven racks on orbit, and install additional scientific equipment.

The IMCE confirms NASA's near-term goal for ISS as "U.S. core complete." The report further suggests that, when the Program/NASA shows adequate acknowledgement and correction for deficiencies identified in management structure, institutional culture and cost estimating within the next two years, there are opportunities to pursue a path to an "end state" with enhanced capabilities.

Our partners have pointed out that "U.S. core complete" is not defined in ISS international agreements, and that their expectation is to have enough crew time on orbit to perform research planned in the multiple labs. The IMCE does not consider it within its scope to recommend how to bridge the gap between what the United States has promised and what the partners expect.

Fulfilling the commitments NASA has made to ISS partners will require support and leadership beyond Program boundaries. We have embarked up this mountain together – to build a bridge for the future and leverage investments in science and people that are expected to yield considerable benefit for the future. We will continue to rely on our "due processes" to keep every aspect of building and operating the ISS moving in a positive direction.

The overall research budget has been reduced 40 percent from the original plan, requiring reorganization and a reprioritization of resources and research goals. This will not be an easy or happy task. We are not relieved of our requirements and obligation to the nation and our partners to perform world-class research in our micro gravity facility.

The Program has already begun rigorous responses to the IMCE recommendations. You will be hearing more details as they develop. We are putting plans in place to improve our processes and management information performance. Success will require the same level of dedication and commitment that resulted in the amazing year and a half of space flight.

The long-term future

We are living in a changing world and human space flight is changing along with it. When the Apollo Program brought back images of what the Earth looks like from space in the 1970s, it had an impact on the way we perceived life on our planet. We are still learning from that experience.

Images from the ISS returned since the beginning of the 21st Century show American and Russian commanders routinely handing off control of a one-of-a-kind space research facility, while an international team of space flight experts hardly miss a beat preparing for the next steps.

I remember the Synthesis Report in 1991 entitled "America On the Threshold." Synthesis Group Chairman Thomas Stafford, in his opening remarks, recalled the great Chinese fleets of the 15th Century that set out to explore the world's oceans beyond where man had ventured before.

A change of policy during the Ming Dynasty arrested the movement and the "great fleets" were burned, just as a new set of explorers from Portugal began venturing out. The lead exploration role soon fell to Spain, and then Britain.

His point was: "Nations lose their leadership position when they give up the role of exploration...and the question is which path to take with regards to the oceans of the 21st Century."

The future is a wide-open door

The ISS Program is not just American. NASA is leading in an effort that is international and every bit as important to Russia, Europe, Canada and Japan as it is to the United States. We may even see "Taikonauts" (Chinese word for Astronaut/Cosmonaut) in Earth orbit sometime in the future.

I believe we will one day conquer the space 240 miles above our head, and we will move back to the Moon 240,000 miles away and onward to Mars, more than 48 million miles further – and beyond.

You've heard me say before that building the International Space Station is like climbing a mountain. Well, we are deep within the mountain range and we've just climbed the steepest peak so far. But the cold wind is in our face, we have to find a place to regroup and get back our view of the summit.

We're on to the challenge around the next bend. It will take patience, innovation and endurance but I'm confident we'll get there. See you on top! ❖